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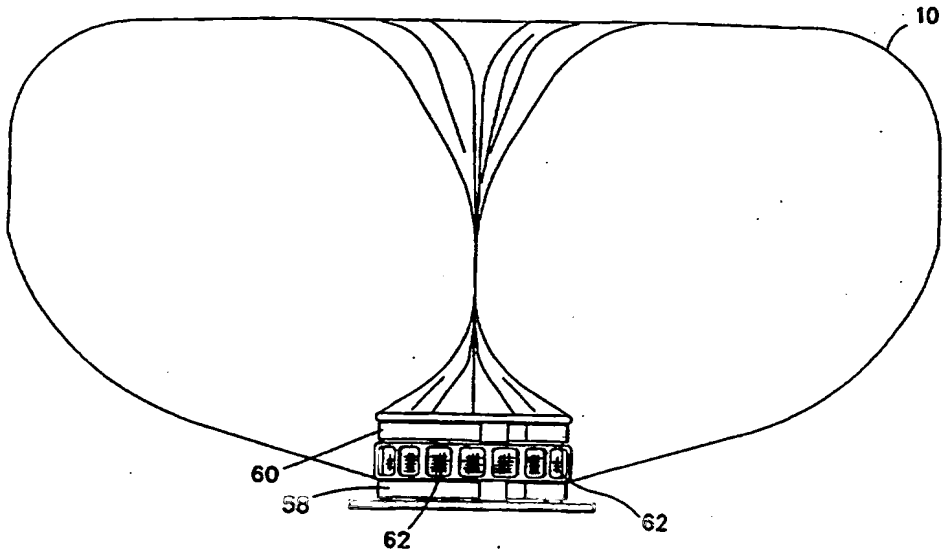
(54) Title: TOROIDAL AIR BAG ASSEMBLY



(57) Abstract

An air bag assembly (10) is provided having a generally toroidal configuration and constructed from a section of tubular material (14). Such tubular material being attached to an inflater (12) such that an annular opening is formed between the ends of the tubular material. In a preferred embodiment mooring rings (32) are spaced to form an annular passage for the inflation gas. The tubular material is inflated to form a distorted torus wherein the axes of symmetry of the torus is generally normal to the vehicle occupant in the event of a collision. Such a configuration avoids the need for load bearing stitching and seams as typically used in prior air bag cushions.

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Description

TOROIDAL AIR BAG ASSEMBLY

Technical Field

The present invention relates generally to an air bag assembly and more particularly, to an air bag having a generally toroidal configuration constructed from a section of tubular material.

Background Art

A gas cushion impact protection device is generally provided with an inflatable gas bag which is integrated into the body portion of a vehicle against which a passenger may be thrown during a collision event. When a sensor detects deceleration values in a vehicle indicative of a collision, a trigger signal for a fuse in a propellant charge forming part of a gas generator is produced. The gas bag is then inflated within a few milliseconds by gases generated by the gas generator. Gas bags housed within the steering columns of vehicles typically are formed of two disk-shaped pieces of material joined together at their periphery wherein an opening is disposed within one of the disk-shaped pieces of material for introduction of the inflation media. Gas bags for use in opposition to passengers within a vehicle are generally composed of a multiplicity of relatively complex shaped material pieces joined together so as to produce a bag having a profile suitable for disposition between a

vehicle occupant and a dash panel or other structure from which the gas bag extends during deployment.

Prior to the present invention, gas bags have typically been characterized by relatively complex seaming structures by which the various components of the bags are joined together. Such seams generally add undesirable complexity to the bags.

The present invention provides a gas bag configuration formed of a tubular construction minimizing the use of load-bearing stitching previously needed. The present invention thereby provides a useful advancement over the state of the art.

Disclosure of Invention

It is a general object of the present invention to provide an air bag assembly having a simplified construction which eliminates the use of load bearing stitching.

It is another object of the present invention to provide an air bag formed from a textile fabric wherein the textile fabric is oriented so that the primary stresses are substantially aligned with the primary yarn directions of the textile fabric.

It is another object of the invention to provide an air bag having excess material in the impact section of the bag structure so as to lessen friction between the air bag and the protected occupant.

It is another object of the present invention to provide an annular air bag assembly which surrounds the central hub of a steering column during inflation.

It is yet another object of the invention to provide vent means integral to the air bag material for deflation of the air bag without sacrificing material integrity during inflation.

It is another object of the present invention to provide an air bag shape having a centering effect upon an occupant's head during a collision event.

It is a further object of the present invention to provide a simplified mounting for an air bag to a reaction canister.

Further advantages and features of the invention will be apparent from the following description of potential embodiments and from the drawings to which reference is made.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1-a is a cross sectional view showing a packed toroidal air bag according to the present invention.

Fig. 1-b is a cross sectional view showing the inflated bag, and illustrating the primary area used for venting and impact.

Fig. 2 is an exploded view the several rings used in one embodiment of the invention for attachment of the air bag to an inflator.

Fig. 3 shows the sectioned end of the fabric tube with stitching as used in one embodiment of the invention.

Fig. 4 shows the stitched end of Fig. 3 gathered to approximately the diametral size of the mooring ring.

Fig. 5 shows the parts to be assembled during mounting of one embodiment of the air bag of the present invention to an inflator.

Fig. 6 is the completed assembly of the components in Fig. 5.

Fig. 7 shows a section of the tubular fabric containing sections with greater pick spacing for venting.

Figs. 8(a) - 8(e) show various means of mooring the sectioned end of the fabric tube, wherein Fig. 8(a) shows a tapered band which when tensioned by the fabric moves up a mating taper on the mooring ring, thereby clamping down on the fabric. Fig. 8(b) illustrate a band which may employ a resilient strip to protect the fabric from cutting. Fig. 8(c) shows the same configuration as 8(b) with the fabric mounted in the opposite sense to the stop. Fig. 9(d) shows the fabric compressed by the band against O-rings located in grooves in the mooring ring. Fig 8(e) shows the fabric compressed between a band and mooring rings with O-rings located above the fabric.

Fig. 9 shows an embodiment employing mooring rings which are integral to the inflation canister.

Fig. 10 illustrates in partial cross section a toroidal air bag packed in the central hub of the steering wheel.

Fig. 11 illustrates a toroidal air bag mounted to an annular inflator and mounted around the central hub of the steering wheel where functional elements (horn, cruise control, etc.) penetrate the bag and inflator.

Fig. 12 illustrates the inflated bag surrounding the central hub of a steering column.

DESCRIPTION

Turning now to the drawings, as illustrated in Figs. 1-a and 1-b, the present invention provides a gas bag 10 of a generally toroidal configuration which may be adjoined to a gas inflator 12 for disposition in opposing relation to a vehicle occupant during a collision. In the illustrated and potentially preferred practice, the gas bag is formed from a tube of woven fabric 14 (Fig. 7). As will be appreciated by those of skill in the art, such tubes may be formed directly on a weaving or knitting machine in a substantially continuous process such as by weaving with a double shed, or can be formed from a flat fabric through the introduction of a single seam along its length. In the illustrated and potentially preferred practice, one end of a formed tube 14 is clamped around the discharge ports 16 of a gas inflator 12 after which the other end of the tube is drawn down through the interior of the tube and attached to the inflation device

so as to form an annular opening between the two ends.

One potentially preferred arrangement for attachment of the gas bag 10 to a gas inflator 12 is illustrated in detail in Figs. 2-6. As illustrated, the inflator 12 may be attached to a module housing 22 in which is disposed a mooring ring structure 24 and a second mooring ring 26 disposed within and having a diameter less than the first. These rings are preferably held one within the other by a bolt 30.

As shown, both the first and second mooring rings structures preferable include flanged neck portions 32 for mating to clamp structures as may be used in holding terminal ends of the fabric tube 14 in place against the mooring rings. By way of example only and not limitation, this attachment may be effected by stabilizing each end of the fabric tube 14 with a hem-like stitch line 34 (Fig. 3). The ends of the fabric tube 14 are then gathered together and passed over the flanged neck portion 32 of the mooring ring (Fig. 5), after which a band 38 is placed around the exterior to hold the fabric tube in place against the flanged neck of the mooring ring (Fig. 6).

By way of example only and not limitation, several potentially preferred arrangements for mooring the sectioned end of fabric tube 14 in place are shown in Figs. 8(a) - 8(e). Specifically, in the embodiment of Fig. 8(a), a tapered band 40 is utilized which, when tensioned by the fabric 14 moves up a mating taper on an opposing mooring ring 42 to hold the fabric securely in

place. In the embodiments of Figs. 9(b) and 9(c), a resilient strip 42 is disposed between a band 44 and a mooring ring 46. In the embodiments of Figs. 9(d) and 9(e) O-rings 50 are utilized to further stabilize a fabric between a band 52 and a mooring ring 54.

It is to be appreciated that a number of alternative arrangements may be utilized to arrange the gas bag 10 to accept the gaseous discharge of an inflator 12. For example as shown in Fig. 9, mooring rings may be integrated to the inflator 12 thereby permitting direct attachment of the ends of the fabric 14 thorough the use of a lower band 58 and an upper band 60 between which are disposed a plurality of gas opening 62 for discharging an inflation medium into the opening formed between the two clamps.

By proper selection of the length and width of the starting material section, any desired aspect ratio (i.e. width to height) of the gas bag 10 may be achieved. In a potentially preferred embodiment, an aspect ratio may be achieved through use of a starting fabric tube wherein the ratio of length to height is approximately equal to Pi.

One potential benefit of the present invention is the ability to control venting characteristics within the gas bag structure through adjustment of the weaving procedures followed during formation of the fabric tube. That is, the weave may be either tighter or looser in various portions of the fabric which is then formed into the bag so as to provide built in venting means rather than the

use of formed vents which are typically used in the industry.

In one potentially preferred practice the fabric closest to the occupant will have a relatively low air permeability due to a tightly woven construction, while the fabric closest to the inflator preferably has a relatively higher air permeability due to a more loosely woven construction.

The application of a variation in weave density to in the fabric tube 14 forming the gas bag 10 of the present invention is illustrated through reference to Figs. 1(b) and 7. As shown, the fabric tube 14 may include alternating segments of loose weave high permeability material 70 and tight weave, lower permeability material 72 (Fig. 7). If the fabric tube 14 is segmented at the boundary 74, 76 so as to dispose a loose weave section at either end of the fabric tube to be used, the formation of the gas bag according to the prior description will result in the placement of the higher permeability material in the area closest to the inflator.

In an additional benefit, the load carried by the bag is in the direction of the primary threads making up the fabric.

In Fig. 10 a toroidal gas bag 10 according to the present invention and utilizing the attachment scheme of Fig. 9 is illustrated in partial cross section packed in the central hub 78 of a steering wheel 80. Fig. 11 illustrates a toroidal air bag according to the present

invention mounted to an annular inflator for disposition around the central hub of a steering wheel where function elements such as a horn, cruise control, telephone, etc. penetrate the interior of the bag and inflator thereby permitting inflation of the bag surrounding the central hub in the manner illustrated in Fig. 12. It will therefore be appreciated that the gas bag according to the present invention may be disposed either in direct opposition to a vehicle occupant sitting in front of the steering wheel or may likewise be disposed in hidden view within the steering column itself which may be desired from aesthetic and function purposes should other components be required to occupy the central portion of the steering hub.

Claims

What is Claimed:

1. An air bag system comprising: an air bag formed from a tube of fabric having a first end and a second end and an inflation device including at least one discharge opening for the discharge of an inflating medium wherein said first and second ends of said tube are disposed in confining relation around said at least one discharge opening so as to define a gas confinement chamber inflatable to a substantially torroidal configuration.

2. An airbag system comprising: an airbag formed from a tube of fabric having a first end and second end with sections of relatively higher and lower permeability fabric along the length of said tube and an inflation device including at least one discharge opening for the discharge of an inflating medium therefrom, wherein said first and second ends of said tube are disposed in confining relation around said at least one discharge opening so as to define a gas confinement chamber inflatable to a substantially torroidal configuration.

3. The invention as in claim 2, wherein a section of relatively higher permeability fabric is disposed

adjacent at least one of said first or second ends of said tube.

4. The invention as in claim 3, wherein a section of higher permeability fabric is disposed adjacent both the first end and the second end of said tube.

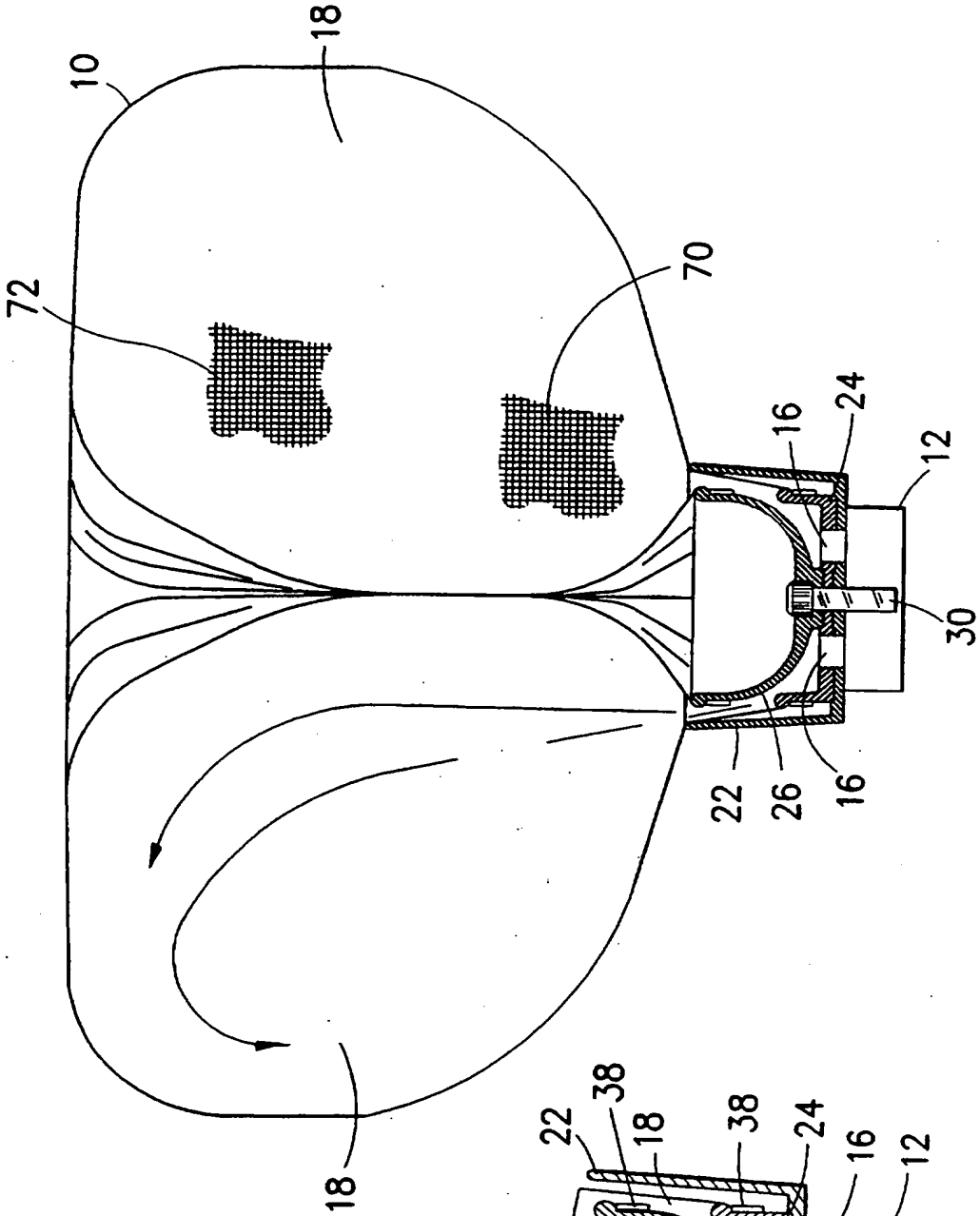

FIG. -1b-

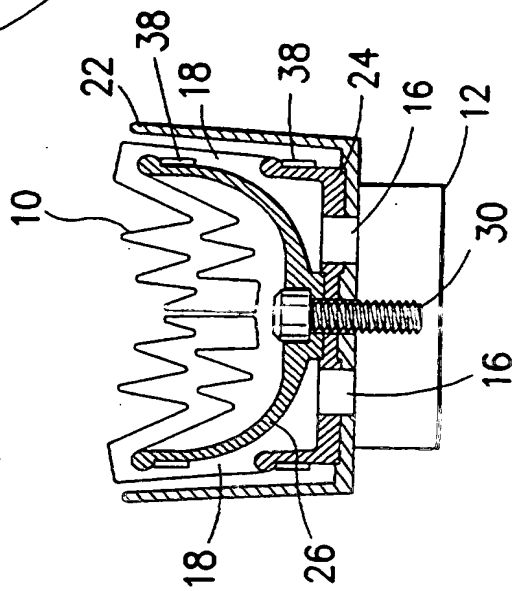

FIG. -1a-

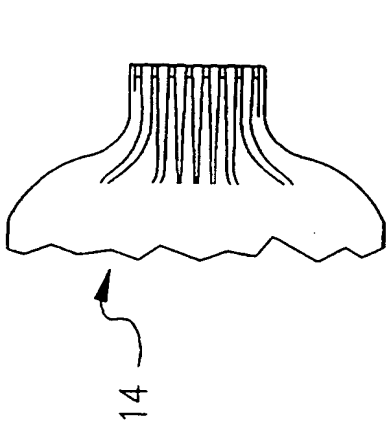

FIG. -4-

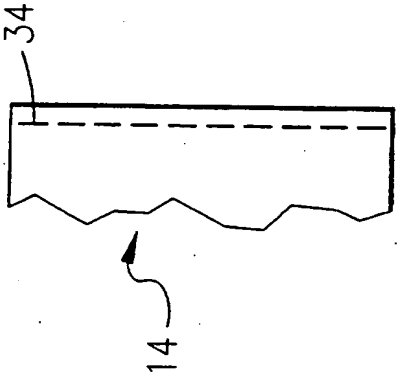

FIG. -3-

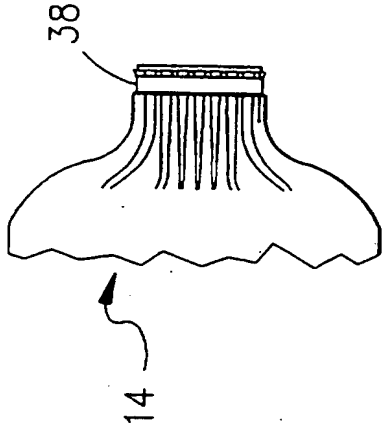

FIG. -6-

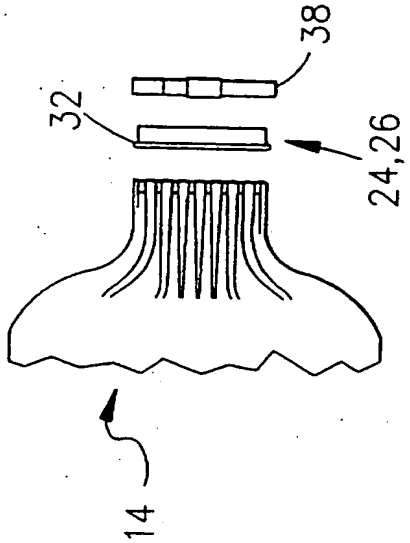

FIG. -5-

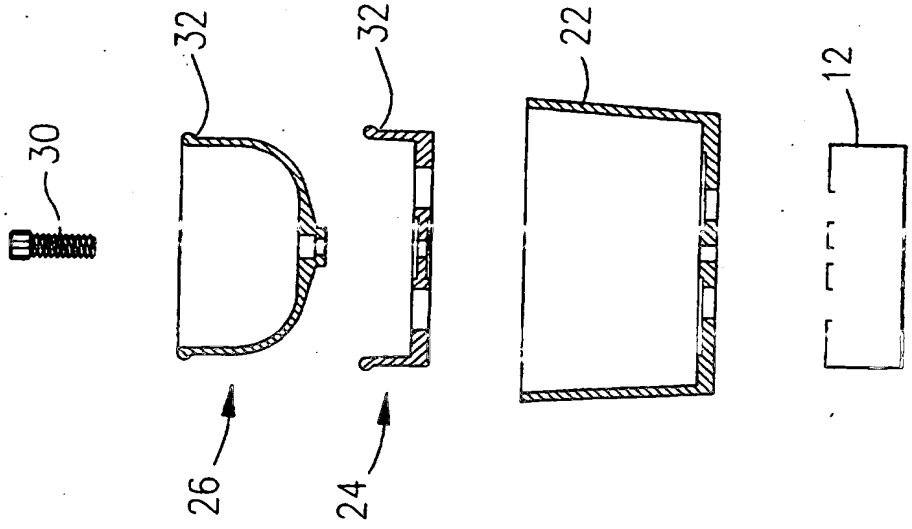

FIG. -2-

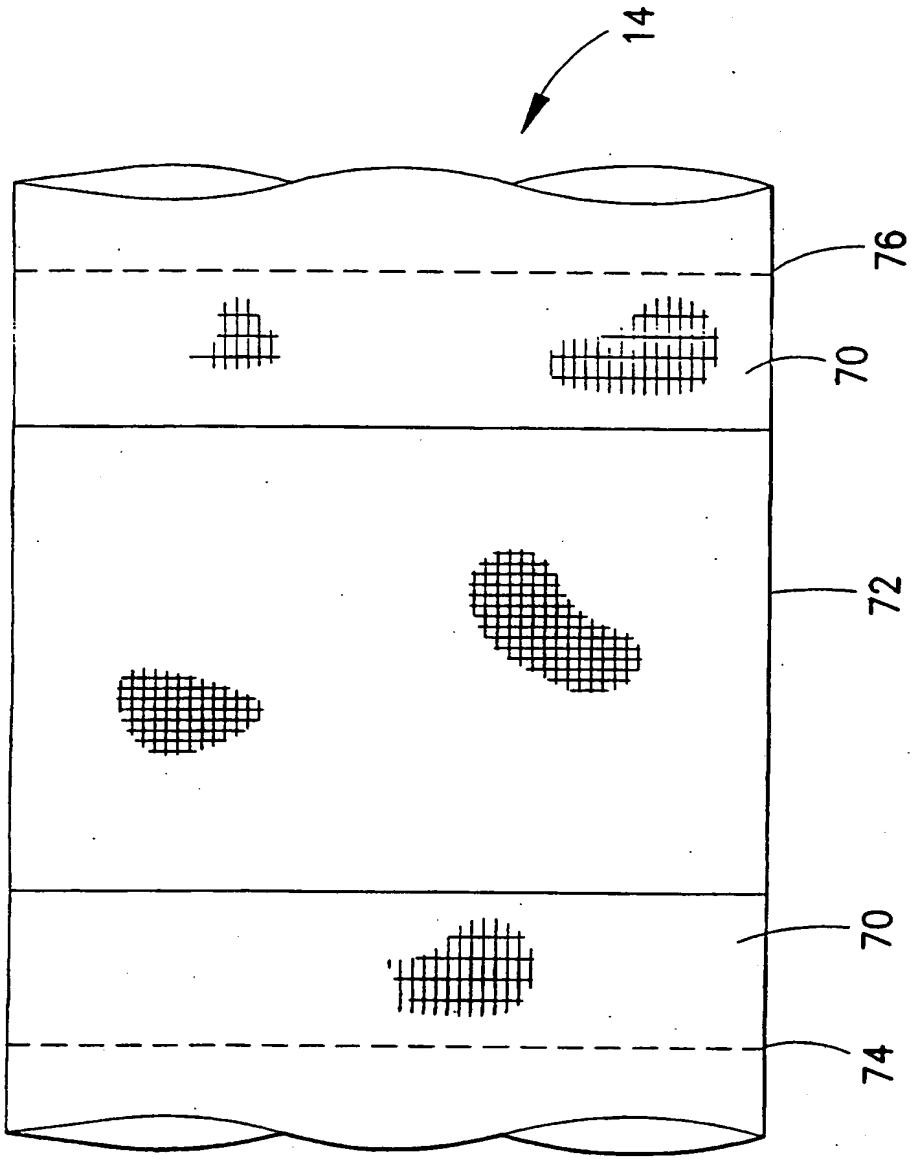

FIG. — 7 —

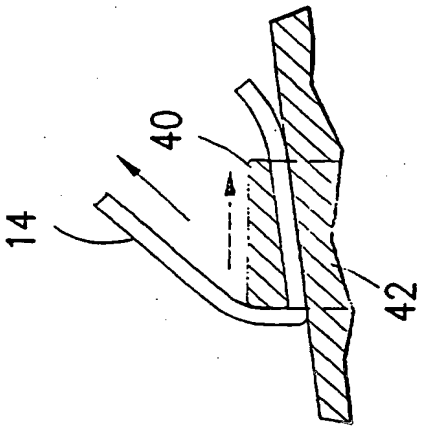

FIG. -8a-

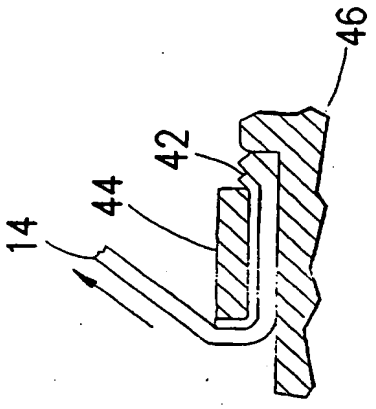

FIG. -8b-

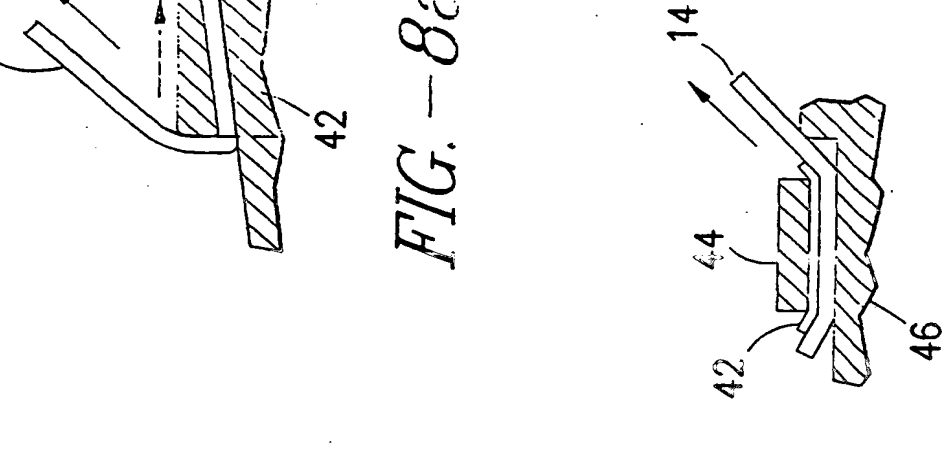

FIG. -8c-

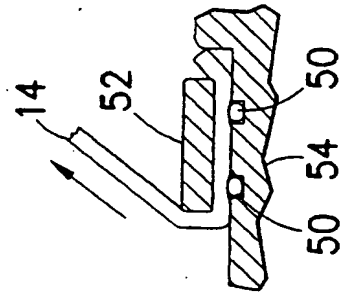

FIG. -8d-

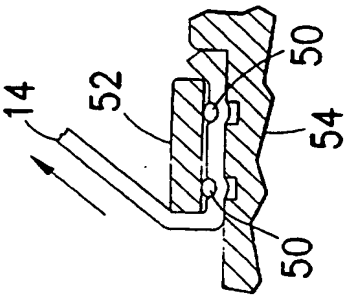

FIG. -8e-

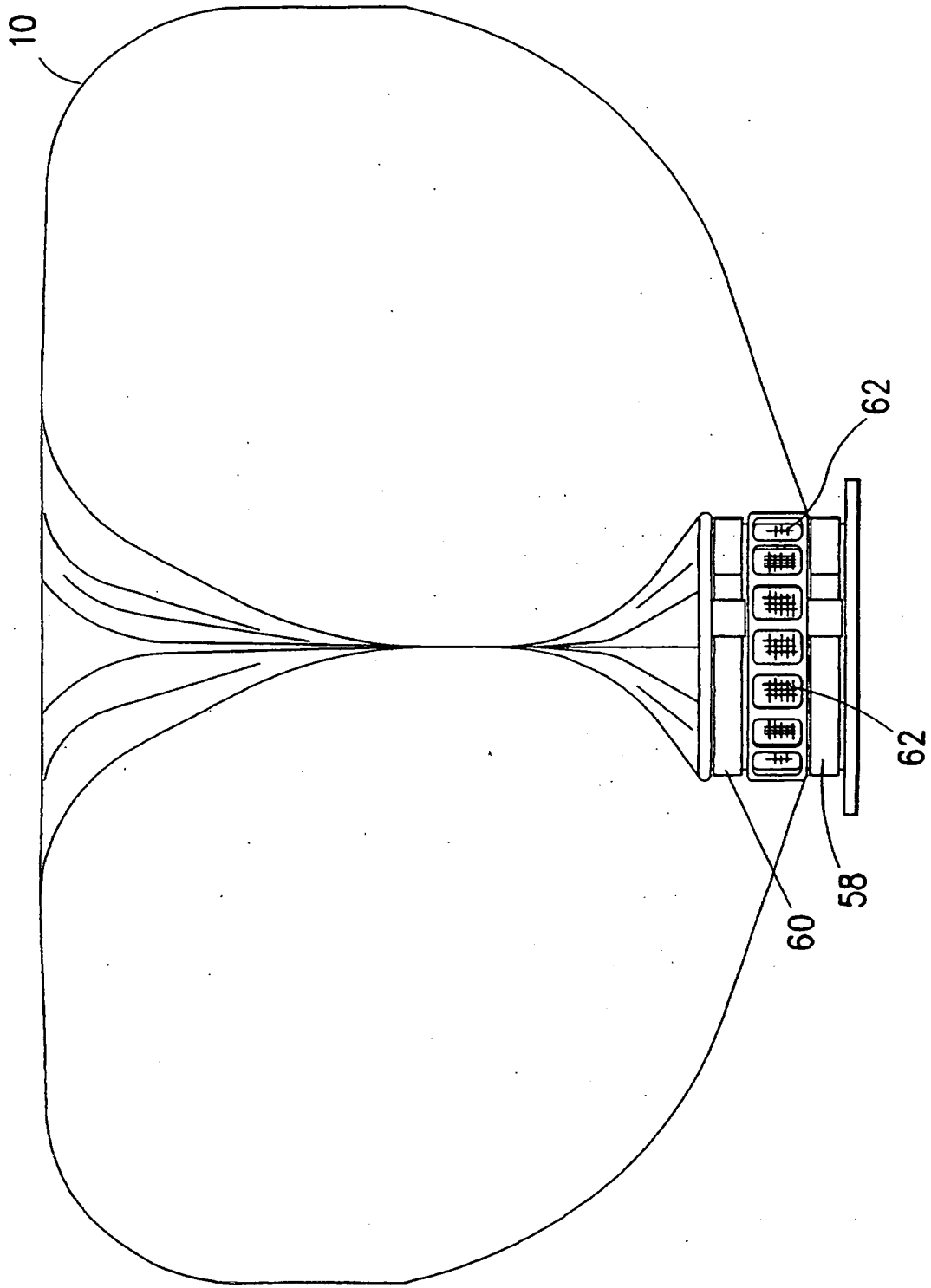

FIG. -9-

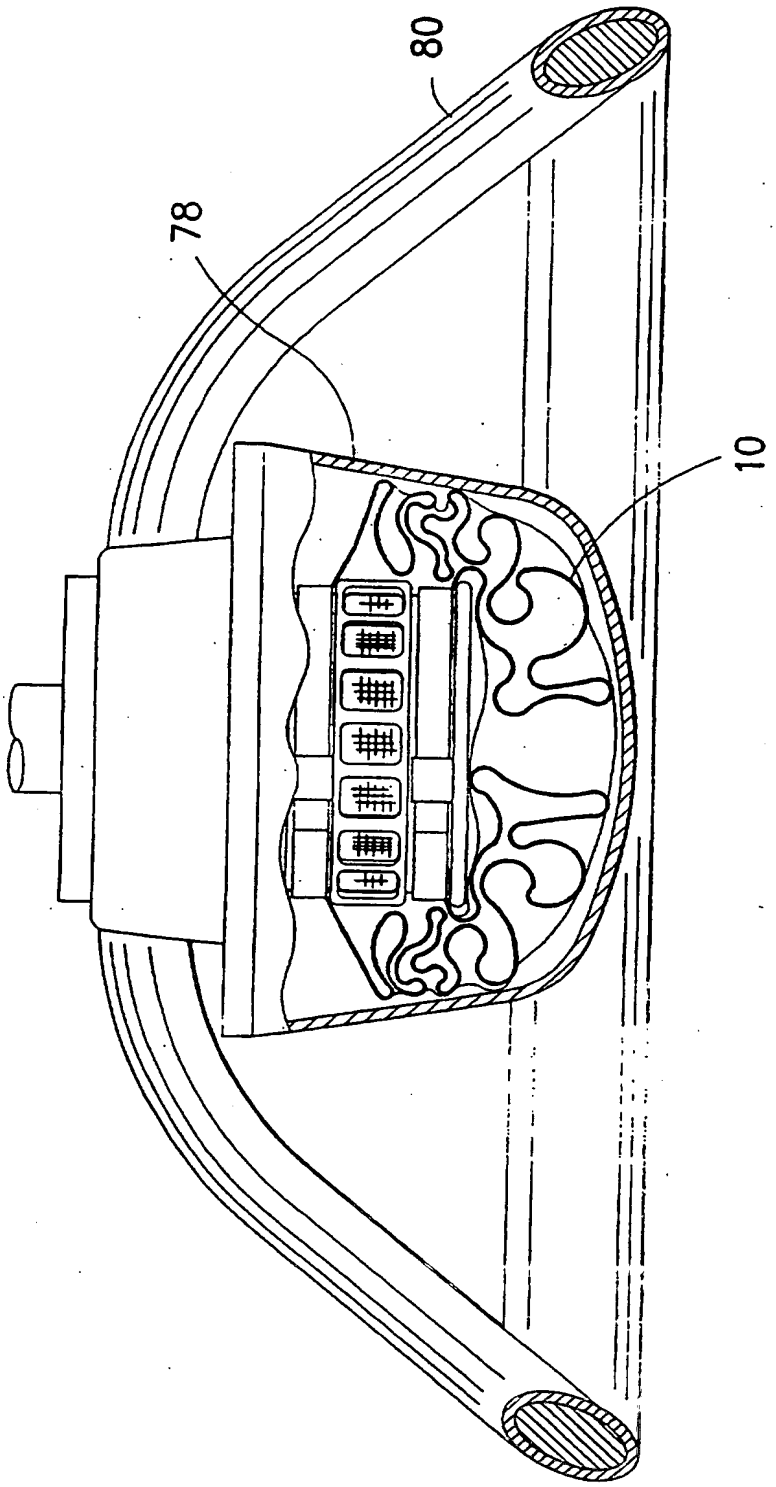

FIG. -10-

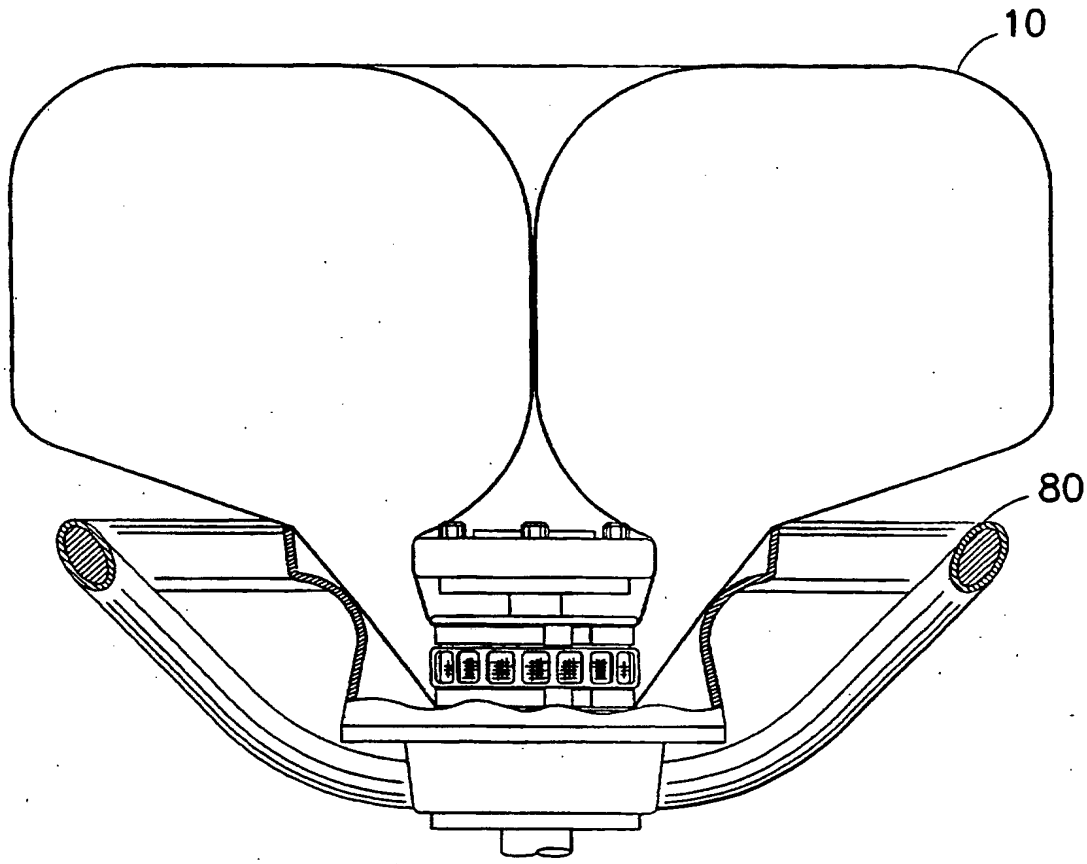

FIG. –12–

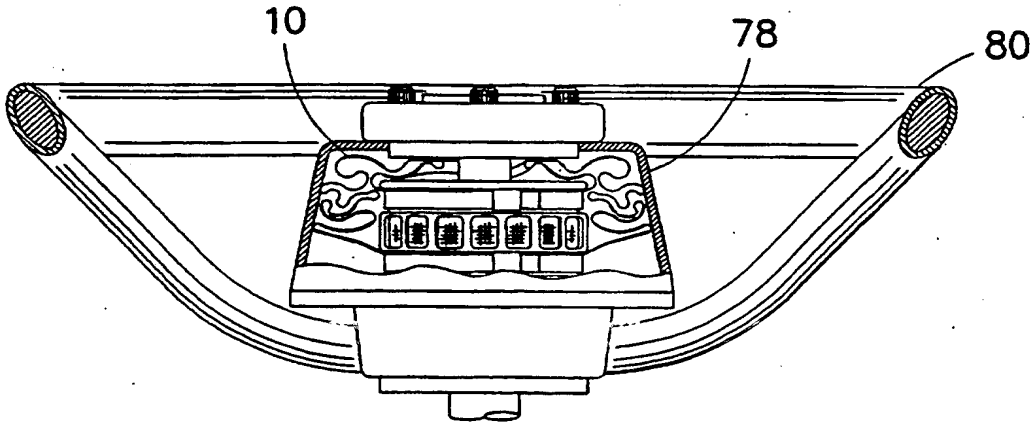

FIG. –11–

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/04339

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B60R 21/20
US CL : 280/743.1, 731

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 280/743.1, 731

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,828,286 A (FÖHL) 9 May 1989, the entire document	1
Y		2-3
Y	US 5,193,847 (NAKAYAMA) 16 March 1993, the entire document	2-3
Y	US 5,280,952 (HIRABAYASHI et al.) 25 January 1994, the entire document	2-3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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